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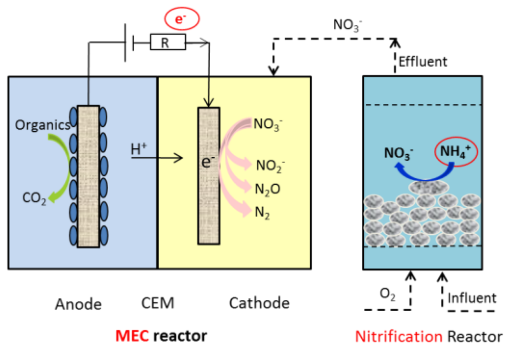
Abstract



Ammonia, known as a notorious pollutant, could cause the lake eutrophication and may inhibit some biological treatment processes as well. In this research, a new biosensor consisting of a microbial electrolysis cell (MEC) and a nitrification reactor was designed for on-line ammonia monitoring in waste streams. In this new biosensor system, firstly wastewater enriched with ammonia was oxidized to nitrate in nitrification stage, and afterwards, the effluent contained with nitrate was pumped into cathode chamber of MEC, where the nitrate was reduced with accepting electrons. The performance of the biosensor was first tested with synthetic ammonia-rich wastewater. The results showed the conversion from ammonia to nitrate achieved a high level with the slope of 0.9976. The current (0.5130 to 3.906 mA) linearly (R^2 = 0.9419) changed with a stepwise increasing of ammonia levels from 0 to 62.1 mg NH_4^+-N/L. At different applied voltage and different pH conditions, the slopes of line changed whereas the good linear relationship was always observed between current and ammonia levels. Moreover, the electrochemcial cell was able to remove the interference of other possible electron acceptors (e.g., NO_3^--N) in the wastewater. At last, the biosensor was tested with real waste streams and the results showed no significant difference between the values monitored by testing kits and that obtained from the biosensor. For the best of our knowledge, this study firstly attempted to illustrate the feasibility of a microbial electrochemical sensor for ammonia monitoring. In light of the simple and efficient operation, the biosensor showed great promising potential for online, inexpensive, fast and reliable ammonia detection in various waste streams.